Advanced Passive Phase Separations for Space Exploration, Phase I

Completed Technology Project (2018 - 2019)

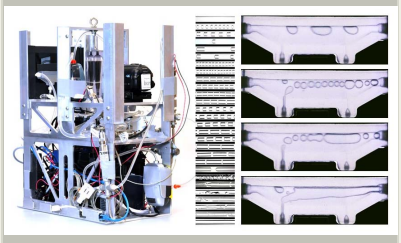
Project Introduction

Nearly all fluid systems aboard spacecraft are, or become, multiphase fluid systems, whether by design or default. Unfortunately, we still do not possess ample understanding of low-g fluid phenomena to assure performance and avoid system failure. Though inadequate fluid system design can lead to disastrous consequences, for the most part, and for life support systems in general, precious crew time is consumed by the repair and maintenance of life support equipment. Long-duration space flight missions to the moon, Mars and other planetary bodies will require hardware that is less prone to failure and significantly more robust than the current state of the art. To prepare for the future during the ISS era, we propose to develop and deliver a simple, yet profound, two-phase flow testbed for use on ISS. The facility will be deployed for the exhaustive measurement, demonstration, and qualification of inertia-visco-capillary two-phase flows—flows critical to myriad low-g fluids conduits, devices, and systems (fuels, coolants, and water processing equipment for life support). Our approach is uniquely tailored to achieve high data rates of both engineering and scientific value in a safe, fast-to-flight, low-cost experiment constructed substantially of flight qualified COTS components. Our two-phase flow data objectives are expected to be highly complementary to the NASA GRC research and NASA JSC life support applications, focusing on the critical performance impacts of container/conduit geometry and poor wetting conditions common to many fluid systems aboard spacecraft. Additionally, our 'low-tech' approach to experiment design and data collection greatly increases the rate and breadth of microgravity two-phase flow research returns to NASA with concurrent reductions in overall program risk.

Anticipated Benefits

The primary data to be collected is of both short- and long-term interest to NASA as it supports the development of a wide variety of systems including air revitalization, water recovery, water management, habitation, waste water treatment, condensing heat exchangers, and other contaminating systems such as plant and animal habitats, laundering and hygiene, food rehydration and dispensing, and others. Highly wetting systems relevant to coolants, cryogens, and propellants may also be addressed.

Data is expected to have a direct impact on commercial aerospace system design for a wide range of critical systems including life support, thermal management, water management and others. The phase separating devices will be qualified in an operational environment generating discrete flow products and design guides that can be integrated into existing and future systems.



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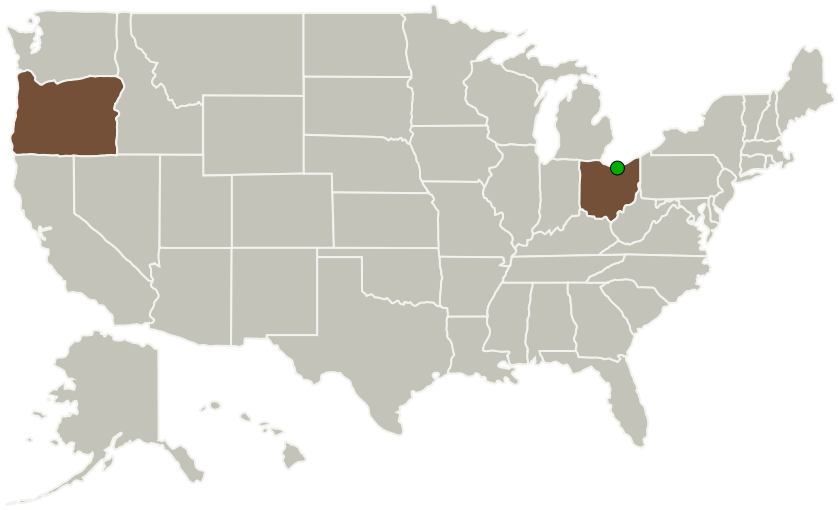
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Irpi, LLC	Lead Organization	Industry	Wilsonville, Oregon
Glenn Research Center(GRC)	Supporting Organization	NASA Center	Cleveland, Ohio

Primary U.S. Work Locations	
Ohio	Oregon

Project Transitions

July 2018: Project Start

February 2019: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/141250)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Irpi, LLC

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

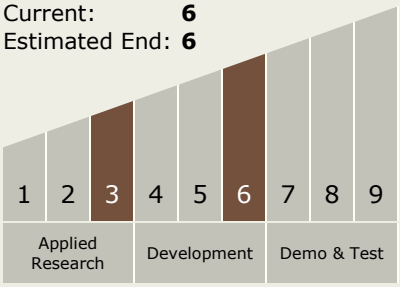
Carlos Torrez

Principal Investigator:

Ryan Jenson

Technology Maturity (TRL)

Start: **3**
Current: **6**
Estimated End: **6**



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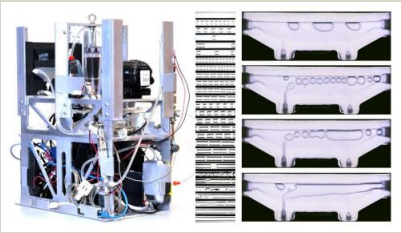
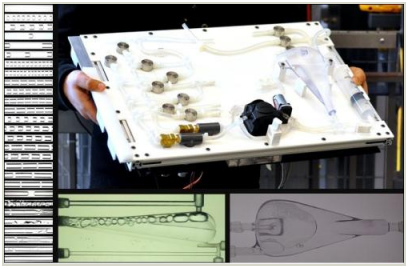
Images



Briefing Chart Image
Advanced Passive Phase Separations for Space Exploration, Phase I
(https://techport.nasa.gov/image/132555)



Final Summary Chart Image
Advanced Passive Phase Separations for Space Exploration, Phase I
(https://techport.nasa.gov/image/135725)

Technology Areas

Primary:

- TX06 Human Health, Life Support, and Habitation Systems
  - TX06.1 Environmental Control & Life Support Systems (ECLSS) and Habitation Systems
    - TX06.1.2 Water Recovery and Management

Target Destinations

The Moon, Mars, Earth